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HIGH FREQUENCY ACOUSTIC PROPAGATION STUDIIES

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LONG TERM GOALS

The long-range scientific objective of our program is to understand the propagation of high frequency sound in the sea and the physical characteristics of the medium that contribute to it.

OBJECTIVES

The objective of this study is to perform a series of experiments at sea in order to measure the relationship of thermal microstructure to acoustic propagation in a shallow water coastal environment. An important question that one would like to answer in understanding the propagation of high frequency sound and its variability is what are the underlying physical causes for this variability. The goal of this project is to perform simultaneous measurement of spatial temperature microstructure and to correlate this niicrostructure and its change to variability in acoustic propagations.

APPROACH

We have recently developed a novel optical instrument (Low light-level Underwater Multispectral Imaging System, LUMIS) for measuring phytoplankton fluorescence in two wavebands, coincidently with the measurement of optical scattering and Raman inelastic scatter. The instrument resolution is still under study however, in principle, given a high enough signal to noise level, the instrument should be capable of measuring thermal microstructure using our optical technique. Our immediate goal is to measure the microstructure to a spatial resolution of I CMA3 with a temperature resolution of I degree C.

WORK COMPLETED

The LUMIS system has been constructed and tested in a laboratory tank and in the field in its first in situ deployments. The system consists of a fiber-optic network which relays the four images from the lenses to the digital camera. Each lens has appropriate filters to image each of the four chosen wavebands. A doubled ND-YAG laser is used to stimulate Raman inelastic scatter with a stimulating waveelength at 532 nm. The system has been deployed in the Red Sea in May, 1997, and in Saanich Inlet in August, 1997.

RESULTS

Since the project is still in quite a developmental stage, we do not have substantial results to present. Previous data indicated that the idea would work, given adequate signal to noise. Our past year was spent in using the limted funds available to this project in upgrading the camera to have the capability for multispectral input. Current efforst are to increase the signal to noise via the aquisition of faster lenses and also to use a line stimulus instead of a plane. Several sea trips are scheduled for FY '98.

IMPACT

This new instrument platform has the possibility of giving us the first in situ view of the microscale patchiness of temperature. When combined with propagation studies we should be able to correlate the thermal variations that we are seeing in space and time with the acoustic variations in propagation. This will lead to a better understanding of the magnitude that thermal effects have on high frequency propagation.

TRANSITIONS

The acquistion and correlation of our instrument with the acoustic variability should allow the prediciton of acoustic variability from a model. This will be valuable for NAVY systems which will use many different types of coherent processing schemes, like Synthetic Aperture Sonar.

RELATIONSHIPS TO OTHER PROJECTS

This work has benefitted other work in Jaffe's laboratory with acoustic imaing systems which work at high frequency. In particular, we have a 445 kHz and 1.6 MHz system that are being used to measure high frequency backscatter. The optical program in Jaffe's lab is also being supported with funds from ONR Biological Oceanography to use the camera for phytoplankton fluorescence.